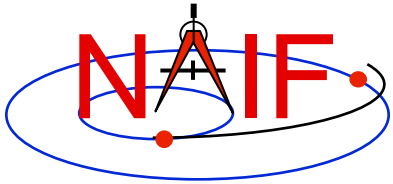


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# Summary of Key Points

November 2014

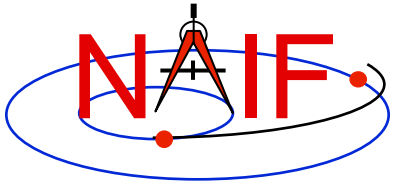


# Which Pieces of SPICE Must I Use?

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- **There's not a simple answer**
  - Depends on what mission you are working on
  - Depends on what computation(s) you wish to make
- **Don't feel overwhelmed**
  - Many complex computations can be made using just a few SPICE APIs
- **The next several charts highlight some key points**
  - We assume you have already looked at the major SPICE tutorials, or already have some familiarity with SPICE
  - We assume you have successfully downloaded and installed the SPICE Toolkit
- **Consider printing this tutorial and keeping it near your workstation**



# Reminder of Key Subsystems

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**SPK:** Position (and velocity) of things

**PCK:** Size/shape/orientation of target bodies

For binary PCKs, only orientation is provided; use a text PCK to obtain size/shape

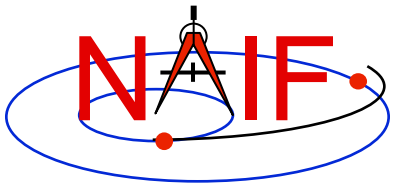
**IK:** Instrument field-of-view geometry (see also FK below)

**CK:** Orientation of spacecraft or spacecraft structures that move

**FK:** Definition and specification details for many reference frames, including instrument mounting alignments

**LSK:** Time conversion: UTC (SCET)  $\longleftrightarrow$  ET (TDB)

**SCLK and LSK:** Time conversion: SCLK  $\longleftrightarrow$  ET (TDB)



# Primary Kernel Interfaces - 1

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**Which SPICE modules are most commonly called to use data obtained from a given kernel type?**

SPK	SPKEZR, SPKPOS, SPKCOV, SPKOBJ
PCK	SXFORM, PXFORM, SPKEZR, SPKPOS, BODVRD
IK	GETFOV, G*POOL
CK	SXFORM, PXFORM SPKEZR, SPKPOS, CKCOV, CKOBJ (CKGPAV, CKGP)

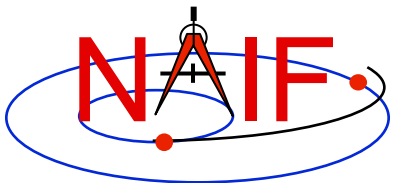
FK	SXFORM, PXFORM, SPKEZR, SPKPOS
LSK	STR2ET, TIMEOUT, SCE2C, SCT2E, SCE2S, SCS2E
SCLK	SCS2E, SCE2S SXFORM, PXFORM, SPKEZR, SPKPOS
DSK	Many: read the DSK documentation

\* DSK is under development;

**Notes:** FURNISH is used to load (provide access to ) all SPICE kernels.

API names shown are for FORTRAN versions:

- use lower case and add an “\_c” when using C
- use lower case and prepend “cspice\_” when using Icy (IDL) and Mice (MATLAB)



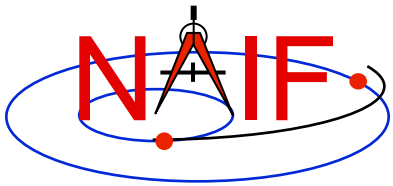
# Primary Kernel Interfaces - 2

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**For a given high-level module, which kind(s) of kernel(s) will or may be needed?**

Module Name	Kernel Type(s) Needed						
	SPK	PCK	IK	CK	FK	LSK	SCLK
SPKEZR, SPKPOS	Y	M		M	M	L	M
SXFORM, PXFORM	M	M		M	L	M	M
CKGP, CKGPAV	M	M		Y	M	L	L
GETFOV			Y				
G*POOL		M	M				
STR2ET, TIMOUT						Y	
SCS2E, SCE2S						Y	Y
CHRONOS (time conversion app.)	M	M		M	M	Y	M

**Y**es = is needed  
**L**ikely = likely needed  
**M**aybe = maybe needed

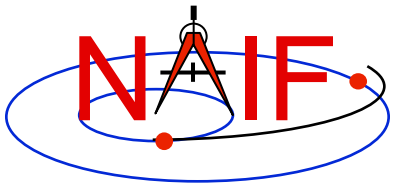


# Kernel “Coverage” Cautions

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- **Your set of kernels must:**
  - contain data for all “objects” of interest
    - » Sometimes you must include intermediary objects that provide a connection (recall the chaining discussion in the SPK tutorial)
  - contain data covering the time span of interest to you
    - » Watch out for data gaps within that time span
    - » Watch out for the difference between ET and UTC
      - The difference as of November 2014 is 67.1825 seconds
  - contain all the kernel types needed by SPICE to answer your question
    - » As the previous charts allude, you may need one or more kernels that are not obvious
  - be managed (loaded) properly if there are overlapping (competing) data within the set of files you are using

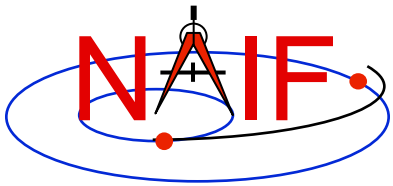


# What Kernels are Available?

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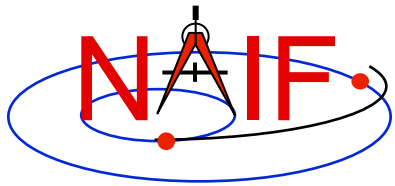
- It depends on the mission or task you are working on...
- If you're working with JPL mission data, there are three categories of kernel data available to you.
  - **Mission operations** kernels – those used by the flight teams to fly the mission and prepare the archival science products
  - **PDS Archived** kernels – those that have been selected from (or made from) the mission ops kernels, and then are well organized and documented for the permanent PDS archive. These data sets also contain helpful meta-kernels.
  - **Generic** kernels – those that are used by many missions and are not tied to any one mission
    - » Relevant generic kernels are usually included in the **PDS Archived** and the **Mission Operations** kernels data sets mentioned above
- The situation might be similar for non-JPL missions, but this is up to whatever agency/institution is producing the kernels.



# How Can I Find Possibly Useful Toolkit Modules?

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- **Review the previous charts**
- **Look at the appropriate SPICE tutorial(s)**
- **Look at the “Most Used xxx APIs” document** `.../doc/html/info/mostused.html`
- **Search the permuted index:**
  - **spicelib\_idx** for the FORTRAN toolkits `.../doc/html/info/spicelib_idx.html`
    - » This index also correlates entry point names with source code files.
  - **cspice\_idx** for the C toolkits `.../doc/html/info/cspice_idx.html`
  - **icy\_idx** for the IDL toolkits `.../doc/html/info/icy_idx.html`
  - **mice\_idx** for the MATLAB toolkits `.../doc/html/info/mice_idx.html`
- **Read relevant portions of a SPICE “required reading” technical reference document (e.g. “spk.req”)**
  - `.../doc/html/req/spk.html` for the hyperlinked html version (best)
  - `.../doc/spk.req` for the plain text version

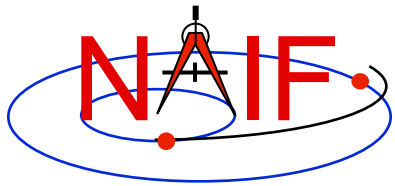


# How Can I Understand How To Use Those Modules?

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- The primary user-oriented documentation about each module is found in the “header” located at the top of each source code file and in the module’s HTML page in the API reference guide.
  - (More documentation is found at the additional entry points for those FORTRAN modules that have multiple entry points.)
- Reference documentation for major subsystems is found in like-named “required reading” documents (e.g. spk.req, ck.req, etc.)
- The SPICE tutorials contain much helpful information.



# Does NAIF Provide Any Examples?

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- **Nearly all module headers contain one or more working examples**
- **“Most Useful SPICELIB Subroutines” has code fragments**  
**.../doc/html/info/mostused.html**
- **The “required reading” reference documents often contain examples** .../doc/html/req/index.html
- **Some simple “cookbook” programs are found in the Toolkit**  
**.../src/cookbook/...**
- **Make use of the SPICE Programming Lessons available from the NAIF server**
  - **[ftp://naif.jpl.nasa.gov/pub/naif/toolkit\\_docs/Lessons/](ftp://naif.jpl.nasa.gov/pub/naif/toolkit_docs/Lessons/)**